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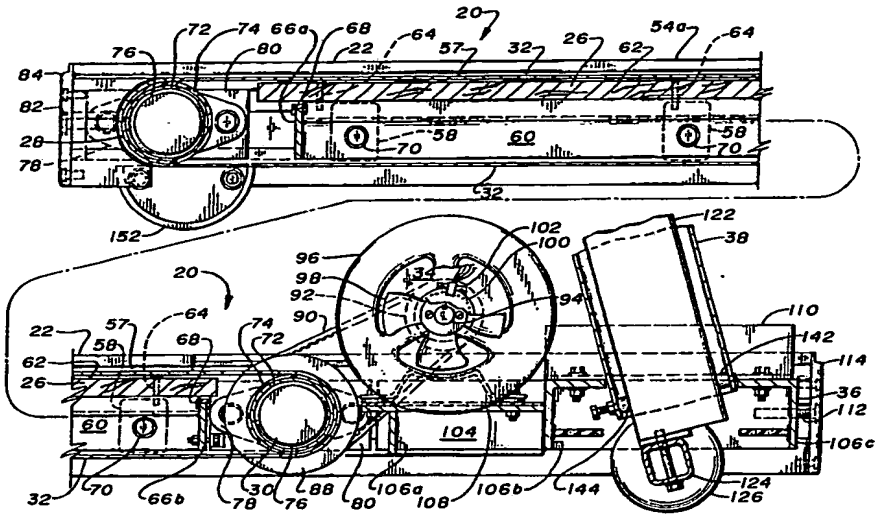

(57) Abstract

An exercise treadmill in which transverse modular components are fixably yet slidably supported through T-slots in extruded side rails (22, 24) having inwardly opening T-slots. Landings (54a, 54b) integral with the side rails cover the edges of the tread belt (32). The bed (26) is carried on bed rails (60) supported on the side rails by bolts extending through the T-slots into bed slides (58). Transverse bed supports (66a-c) capped by resilient shock mounts support the center of the bed. Idler and drive rollers (28, 30) at opposite ends of the bed are slidably supported through the T-slots of the side rails on bearing slides (80). The rear idler roller is adjustably positioned by bolts (82) engaging end caps (84) at the rear ends of the side rails. A motor (34) moves the tread belt (32) over the bed and rollers. An inertial flywheel (96), fan (98) and encoder wheel (100) are mounted on the motor axle. Linear lift mechanism (44) within the stanchion (38) raises and lowers the treadmill.

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MODULAR EXERCISE TREADMILL

Description

Background of the Invention

Technical Field

This invention relates to exercise machines, and more particularly to exercise treadmills for running in place.

Description of the Prior Art

Exercise treadmills provide convenient means for walking and running in place. They are frequently used in health and exercise clubs and in cardiovascular and sports medicine clinics, and are increasingly found in the home.

An exercise treadmill essentially comprises an endless tread belt encircling spaced-apart rollers supported on a frame, a flat, low-friction bed below the upper reach of the tread belt, motor means driving one of the rollers and moving the tread belt over the rollers and bed, and a handhold to be grasped by the runner. The frame supporting the bed, rollers, motor and handhold is typically welded or bolted together, making disassembly for maintenance extremely difficult.

Exercise treadmills require regular maintenance to avoid damage to or breakdown of their components. The tread belt is subject to particularly heavy wear as it is compressed between the runner's shoes and the upper surface of the bed. Treadmill belts may require changing every two thousand to three thousand miles of use and sometimes much sooner. The upper surface of the treadmill bed is typically coated with a friction

reducing material which may be gradually worn down by the tread belt under the impact of the runners feet. The bearings on which the rollers are journaled may require lubrication or other maintenance. In addition, gradual stretching of the tread belt may require adjustment of the distance between the rollers to maintain proper belt tension. Existing designs for exercise treadmills often require that such maintenance procedures be performed by trained technicians. Maintenance by the user may be quite difficult or impractical.

Early exercise treadmill designs such as that described in Trulaske et al. U.S. Patent No. 4,616,822, provide only a level running surface. More recent exercise treadmill designs, such as that described in Viander U.S. Patent No. 4,664,371, allow one end of the treadmill to be raised in order to provide an inclined running surface. Such inclinable exercise treadmills more realistically simulate walking or running over varied terrain, and thus provide more complete exercise to the user.

Current exercise treadmill designs typically include a horizontal display and control panel supported immediately forwardly of the hand hold. This panel includes means for starting the motor to begin movement of the tread belt, and means for stopping the motor and the tread belt. Other elements on the display panel may include: means for increasing and decreasing the speed of the tread belt; means for displaying the tread belt speed; means for increasing and decreasing the incline of the treadmill; and means for displaying the incline. On many existing exercise treadmills, once the user has started the tread belt moving it will continue to move until the means for stopping the motor and belt is activated. This can present a significant safety risk if the user stumbles or falls, or if a foreign object is dropped onto the tread belt and becomes lodged in the

interior of the treadmill. The edges of the upper reach of existing treadmill belts are typically exposed to view. This may allow fingers, toes or foreign objects to slip beneath the belt and be seriously damaged.

Summary of the Invention

It is thus an object of this invention to provide an exercise treadmill that can be readily assembled and disassembled by the user to facilitate maintenance and repair of the machine.

It is a further object of this invention to provide a reliable, precise, linearly operating, powered lift mechanism for inclining the treadmill.

It is another object of this invention to provide an exercise treadmill in which the edges of the upper reach of the tread belt are covered and protected against damage.

It is yet another object of this invention to provide means for sensing the presence and absence of a user on an exercise treadmill and automatically activating and deactivating the means for controlling the treadmill motor.

These and other objects are provided by a treadmill comprising first and second parallel side members, a horizontal bed between the side members, means for supporting the bed on the slide members, an endless belt encircling the bed, first and second rollers at opposite ends of the bed, means for rotatably supporting the rollers, and means for moving the belt over the bed and rollers. The side members have T-slots opening toward the opposite side member and extending substantially the full length of the side member. The T-slots include an interior channel in the side member having a vertical dimension greater than the vertical dimension of the opening of the T-slot. The means for supporting the bed on the side members fixably yet slidably engages the T-slots of the side members. The

rollers are positioned transversely between the side members within a circumference of the belt at opposite ends of the bed. The means for supporting the rollers fixably yet slidably engages the T-slots of the side members.

The objects of this invention are also provided by a lift mechanism for a treadmill comprising an upstanding outer tube, an inner tube slidable within the outer tube, and means for extending and retracting the inner tube from the lower end of the outer tube. The outer tube is fixedly attached at a selected end of the treadmill, while the lower end of the inner tube is supported on the floor or other surface below the treadmill. When the inner tube is extended relative to the outer tube, the selected end of the treadmill is raised.

These and other objects are also provided by a treadmill having side members, a horizontal bed supported between the side members, transverse rollers supported between the side members at opposite ends of the bed, a belt encircling the bed and rollers, means for moving the belt over the bed and rollers, and means extending inwardly from each side member toward the opposite side member for covering the edges of the belt.

Other objects, features and advantages of the invention will become apparent from the following detailed description of typical embodiments thereof, taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

FIG. 1 is an overall top plan view of an exercise treadmill according to the present invention, omitting the display and control panel and the handhold.

FIG. 2 is a right side elevational view of the treadmill of FIG. 1, with the hood broken away to show the motor and the base of the stanchion.

FIG. 3 is a detailed, longitudinal cross-sectional view taken along the line of 3-3 of FIG. 1, showing particularly the means for mounting the rollers, bed and motor support in the T-slot of the side rails.

FIG. 4 is a transverse cross-sectional view taken along the line 4-4 of FIG. 1, showing the side rails, landings, and the rear idler roller.

FIG. 5 is a transverse cross-sectional view taken along the line of 5-5 of FIG. 1, showing the tread belt and bed.

FIG. 6 is a transverse cross-sectional view taken along the line of 6-6 of FIG. 1, showing the side rails, landings, and the front drive roller and roller sprocket.

FIG. 7 is a transverse cross-sectional view taken along the line 7-7 of FIG. 1, showing the motor, motor sprocket, and flywheel, and the motor support frame.

FIG. 8 is a detailed top plan view of the forward portion of the treadmill of FIG. 1, showing the motor and fly wheel, the motor support frame and the lower portion of the stanchion.

FIG. 9 is a partially cross-sectional front view of the stanchion and lift mechanism of the treadmill of FIG. 2, taken perpendicularly to the stanchion.

FIG. 10 is a side elevational, partially cross-sectional view
of the lift mechanism of FIG. 9.

FIG. 11 is a detailed, top plan view of the display and control panel and the handhold atop the stanchion of the treadmill of FIG. 1.

Description of the Preferred Embodiments

As seen in FIGS. 1 and 2, an exercise treadmill 20 according to this invention comprises multiple modules supported between left and right side rails 22, 24. A flat, horizontal, elongated bed 26 is supported between the side rails 22, 24, with an idler roller 28 at a rearward end of the bed and a drive roller 30 at the opposite forward end of the bed. An endless tread belt 32 longitudinally encircles the bed 26 and rollers 28, 30. The drive roller 30 is rotated by a motor 34 fixedly mounted forwardly of the drive roller on a front support frame 36. The front support frame 36 also supports an upstanding stanchion 38 having as its upper end a display and control panel 40 and a handhold 42 extending rearwardly from the panel. A lift mechanism 44 contained within the stanchion 38 and supported on the floor or other surface beneath the treadmill 20 raises and lowers the forward end of the treadmill. A lower electronic circuit board 46 carried on the motor support frame 36, and an upper electronic circuit board 48 within the display and control panel 40, precisely control and monitor the motor 30, lift mechanism 44, and display and control panel 40.

As seen in FIGS. 3-7 the left and right side rails 22, 24 are substantially mirror-image extruded aluminum members. Because the side rails 22, 24 are mirror images, the same extrusion stock can be used for both side rails. Each side rail 22, 24 includes a T-slot for receiving various means for mounting the transverse modular components of the treadmill. The T-slot is so named because it takes the shape of a squat "T" oriented with the stem pointing horizontally and inwardly toward the opposite side rail, and with the cap of the "T" oriented vertically along the longitudinal center line of the side rail. The stem of the T-slot thus comprises a slot 50 extending along the full length of the inside vertical face of the side rail and facing

inwardly toward the opposite side rail. The cap of the T-slot comprises a vertically elongated channel 52 extending the full length of the side rail along the longitudinal center line thereof. The vertical dimension of the interior channel 52 is greater than the vertical dimension of the side slot 50, thereby forming the T-slot for providing means for modular assembly and disassembly of the treadmill 20.

Landings 54a, 54b are provided to allow the user to step on and off the treadmill 32. The landings 54a, 54b are extruded integrally with and extend the full length of the side rails 22, 24 respectively. The flat, horizontal landings 54a, 54b are cantilevered above their respective side rails 22, 24, extending inwardly toward the opposite side rail. The landings 54a, 54b extend inwardly over the side edges of the tread belt 32. This provides a significant safety feature because it prevents fingers, toes, and other foreign objects from becoming lodged between the belt 32 and the bed 26 and thereby being injured or damaged.

Each landing 54a, 54b supports a respective inset landing tread 56a, 56b extending the entire length of the landing, and thus of the respective side rail 22, 24. The landing treads 56a, 56b comprise ninety durometer (A scale) extruded vinyl, formed into a flat cross-section with substantially semi-circular longitudinal grooves along the upper surface. The landing treads 56a, 56b are inset between upstanding, C-shaped longitudinal edge portions of the landing 54a, 54b. The provision of landings 54a, 54b formed integrally with their respective side members 22, 24 further contributes to the modular nature of the treadmill 20 by reducing the number of components requiring separate assembly and attachment.

As shown in FIGS. 3, 5 and 8, the bed 26 is positioned horizontally between the side rails 22, 24 by bed slides 58 within the channel 52 of the T-slots of

the side rails, and by bed rails 60 fixedly yet removably attached to the bed slides. The bed 26 is suitably a rectangular piece of three-quarter inch (3/4") thick, high density particle board. At least the upper surface of the bed 26 is coated with a 0.005-0.010 inch thick waxed phenolic layer 62 to minimize friction between the bed and the belt 32. The bed is fixedly attached along its longitudinal side edges to the longitudinally extending bed rails 60 by thread forming screws 64.

The bed rails 60 are vertically oriented, extruded aluminum members extending substantially the entire length of the bed 26. An upwardly opening, U-shaped channel in the top surface of each bed rail 60 accepts the thread forming screws 64 which attach the bed 26 to the bed rails 60. An outwardly extending guide portion of the outer vertical surface of the bed rail 60 fits relatively snugly into the inwardly opening slot 50 of each of the side rails 22, 24. The outwardly extending guide portions of the bed rail 60 do not extend completely through the slots 50. A lower vertical flange portion of each bed rail 60 extends downwardly below the outwardly extending guide portion of the bed rail in proximate contact with the inner vertical surface of the side rail immediately below the slot 50.

Three transverse bed supports 66a-c provide additional support for the longitudinal mid-section of the bed 26. The bed supports 66a and 66c are flat, rectangular, vertically oriented metal members welded to and extending transversely between the longitudinal bed rails 60. A first bed support 66a is positioned just forwardly of the rearward edge of the bed 26. The second bed support 66b is positioned just rearwardly of the forward edge of the bed 26. The upper edges of the bed supports 66a, 66b are separated from the lower surface of the bed 26 by a gap. A resilient, extruded

rubber shock mount 68 is disposed in the gap between the bed 26 and each bed support 66a, 66b to cushion any impact therebetween. The shock mount 68 is of rectangular cross-section with a downwardly opening channel receiving the upper edge portion of the respective bed support. The upper surface of the shock mount 68 is in contact with the lower surface of the bed 26. A transverse crossbar 67 extends between the lower edges of the side rails 22, 24 about midway between the bed supports 66a, 66b. The crossbar 67 is fixedly attached to the side rails 22, 24 by thread forming grooves extending upwardly through the crossbar into a downwardly opening channel extruded into the side rails.

The bed rails 60 carrying the bed 26 and the bed supports 66a, 66b are slidably yet fixably supported on the side rails 22, 24 by the bed slides 58. Each bed slide 58 comprises a flat, rectangular, metal plate sized to slide readily within the vertical channel 52 of the T-slot of each of the side rails 22, 24. The vertical dimension of each of the bed slides 58 is only slightly less than the vertical dimension of the channel 52, and is preferably greater than the horizontal dimension of the bed slide. Each bed slide 58 includes a threaded hole aligned with the open slot 50 of the T-slot of the side rail. Bed slide bolts 70 in unthreaded holes in the bed rails 60 extend through the bed rails and the slots 50 of the T-slots of the side rails 22, 24 into the threaded holes of the bed slides 58. Because the outwardly extending guide portions of the outer surfaces of the bed rails 60 do not extend completely through the slots 50 of the T-slots of the side rails 22, 24, there are gaps between the bed slides 58 and the bed rails 60. Thus when the bed slide bolts 70 are tightened, the bed slides 58 and bed rails 60 are urged toward each other and are clamped against the side rails 22, 24, thereby fixedly supporting the bed 26 on the side rails. When the bed slide bolts 70 are loosened,

the bed rails 60 are slidable within the T-slots of the side rails 22, 24.

A spacer 57 below the inward, free edge of each of the landings 54a, 54b supports the free end of said landing on the upper surface of the bed 26, and prevents excessive transverse movement of the tread belt 32. Each spacer is a relatively hard, 97 durometer (A scale) extruded vinyl member. The cross-section of each spacer 57 comprises substantially rectangular lower portion abutting the bed 26, and a dove-tail molded upper portion. A downwardly opening dove-tail channel 59 extending the full length of each landing 54a, 54b receives the dove-tail molded upper portion of the respective spacer 57, thereby supporting the spacer between the landing and the upper surface of the bed 26. By preventing excess transverse movement of the tread belt 32, the spacer further aids in covering the side edges of the tread belt 32, contributing to the runner's safety while using the treadmill 20.

The rollers of the treadmill 20 are journaled within external roller bearings slidably yet fixably supported on the side rails 22, 24, as shown in FIGS. 3, 4, and 6. Each roller comprises a cylindrical metal tube 72 around which is cast an 80 durometer (A scale) urethane cladding 74. The cladding 74 is crowned, the thickness of the cladding at the ends of the roller being about one half the thickness at the rollers midpoint. This crowning of the cladding 74 aids in maintaining the position of the tread belt 32 along the longitudinal center line of the bed 26, where the belt tension is greatest. The urethane cladding 74 is cast in place to its final thickness so that no grinding is required to produce the crown at the middle of the roller 28, 30.

A stub axle 76 is press fit into each end of each roller 28, 30. Each stub axle 76 comprises a larger diameter cylindrical portion which fits tightly

into the metal tube 72 of the roller and a flat circular end cap having the same diameter of the outer surface of the metal tube 72. A smaller stub portion integral with the end cap extends concentrically outwardly away from the roller 28, 30. The opposite ends of the stub axle are beveled slightly to aid assembly.

The outwardly extending stub portion of each stub axle 76 is received within a flanged ball bearing 78 fixedly attached to a bearing slide 80 extending through the slot 50 into the channel 52 of the T-slot of one of the side rails 22, 24. Each flanged ball bearing 78 comprises a rotatable central portion journaled on ball-bearings within a fixed outer portion. The outwardly extending stub portion of each stub axle 76 is received snugly within the central rotating portion of one of the flanged ball bearings 78. The fixed outer flange of each ball bearing 78 is bolted to its respective bearing slide 80 in two places to prevent rotation.

As best seen in FIGS. 4 and 6, the bearing slides 80 are identical aluminum extrusions. An inward flange of each bearing slide 80 abuts its respective flanged ball bearing 78, while an outward flange of the bearing slide 80 slides within the channel 52 of the T-slot of one of the side rails 22, 24. The bearing slide 80 provides slidable means extending through the T-slots of the side rails for rotatably supporting the rollers.

The bearing slides 80 are selectively fixable in place longitudinally along the side rails 22, 24 to maintain proper tension of the tread belt 32. The bearing slides 80 of the rear, idler roller 28 are held in position along the side rails 22, 24 by belt adjusting bolts 82 extending through end caps 84a, 84b capping the rearward ends of the side rails 22, 24 respectively. The end caps 84a, 84b are molded ABS (acrylonitrile-butadiene-styrene) members oriented

transversely and vertically, with their outer and upper edges flush with the outer and upper surfaces of their respective side rails 22, 24. The heads of the belt adjustment bolts 82 rest within circular recesses in their respective end caps 84. The shafts of the belt adjustment bolts 82 extend longitudinally through holes in the end caps 84 into the channel 52 of the T-slot of the respective side rail 22, 24, and threadably engage key-hole shaped channels 86 in the bearing slides 80. The belt adjustment bolts 82 are thread-forming bolts sized to securely hold the bearing slides 80 of the rear, idler roller 28 against forward movement toward the bed 26. Rearward movement of the bearing slides 80 of the rear idler roller 28 is prevented by the tension of the tread belt 32.

The bearing slides 80 for the front, drive roller 30 and the bearing slides for the rear idler roller 28 are formed from the same aluminum extrusion and slide within the T-slots of the side rails 22, 24 in the same manner. Forward movement of the front bearing slides 80 is prevented by the belt adjustment bolts 82 at the rear end of the treadmill 20. The force from the belt adjustment bolts 82 is communicated to the bearing slides 80 of the front drive roller 30 via the rear bearing slides engaging the belt adjustment bolts, the rear idler roller 28 mounted on the rear bearing slides, and the tread belt 32 encircling both rollers.

Referring now to FIGS. 6 and 8, the drive roller 30 includes a roller sprocket 88 at its left end. A drive belt 90 encircles the roller sprocket 88 and a motor sprocket 92 of the motor 34 so that operation of the motor moves the tread belt 32 over the bed 26 and rollers 28, 30. The roller sprocket 88 is fixedly attached around the left end of the drive roller 30 by three thread-forming bolts extending through an annular, vertical portion of the roller sprocket into the left stub axle 76 of the drive roller. Because the

roller sprocket 88 extends vertically above the drive roller 30, the landing 54 and landing tread 56 are cut away around the roller sprocket and the motor sprocket 92, as best seen in FIGS. 1 and 8.

The tension of the drive belt 90 urges the left side of the drive roller 30 forwardly, which tends to throw the tread belt 32 out of alignment. For this reason, the left front bearing slide 80 is fixedly yet removably attached to the front bed support 66b by a drive roller support ear 89 affixed perpendicularly to the lower rearward corner of the left front bearing slide 80 and extending inwardly and vertically therefrom. The drive roller support ear 89 and the front bed support 66b are bolted together by a conventional threaded bolt and nut, securing the left front bearing slide 80 to the bed assembly and thereby preventing forward movement under the urging of the drive belt 90.

The motor 34 is mounted forwardly of the drive roller 30 on the front support frame 36, to which it is securely bolted. As best seen in FIGS. 3, 7 and 8, the motor suitably comprises a ninety volt or one hundred eighty D.C. motor having the motor sprocket 92 mounted at one end of an axle 94, and a heavy inertial flywheel 96 mounted at the opposite end of the axle. The motor sprocket 92 engages the drive belt 90 so that operation of the motor 34 causes corresponding rotation of the drive roller 30 and movement thereby of the tread belt 32 over the bed 26 and rollers 28, 30. The motor sprocket 92 is one half the diameter of the roller sprocket 88, producing a 2:1 step down in shaft revolutions from the motor 34 to the drive roller 30. This step down reduces the peak loads experienced by the motor 34, which particularly occur when the runner's feet land on the tread belt 32.

The inertial flywheel 96 is significantly heavier than those found in prior art exercise

treadmills in order to further reduce the peak loads placed on the motor 34. A fan 98 recessed within the outer surface of the flywheel 96 draws air between the spokes of the flywheel 96 and over the air inlet grill of the motor 34. An encoder wheel 100 is mounted on the axle 94 between the motor 34 and the flywheel 96. A photoelectric encoder pickup 102 detects rotation of the encoder wheel 100 for use in monitoring and controlling the rate of rotation of the motor axle 94 and drive roller 30 and thus the speed of the tread belt 32 over the bed 26.

The front support frame 36 supports the motor 34 and the stanchion 38 slidably yet fixably on the side rails 22, 24 through the T-slots thereof. The front support frame 36 comprises left and right front slides 104 sliding within the T-slots of the side rails 22, 24, three transverse cross members 106a-c welded to and extending transversely between the front slides, two longitudinal motor support plates 108, and two longitudinal stanchion support angles 110. The front slides 104 are formed from the same aluminum extrusion used for the bearing slides 80. The front cross members 106a-c are welded to the inner flanges of the front slides 104.

As best seen in FIG. 7, the rearwardmost front cross member 106a is a flat metal bar oriented vertically and spaced closely forwardly of the rearward end of the front slides 104, which ends are in turn spaced closely forwardly of the front ends of the front bearing slides 80 of the drive roller 30. The middle front cross member 106b of the front support frame 36 is a metal angle having flanges extending forwardly and downwardly, and spaced about midway along the front slides 104. The motor support plates 108 extend horizontally from the middle front cross member 106b rearwardly over and slightly beyond the rearwardmost front cross member 106a. The motor support plates 108

are spaced downwardly below the level of the horizontal flange of the middle front cross member 106b, thereby reducing the height of the motor 34 and flywheel 96 above the landings 54a, 54b. The motor 34 is bolted to the motor support plates 108 by conventional threaded bolts and nuts.

The front slides 104 of the front support frame 36 are held in place longitudinally along the side rails 22, 24 by front adjustment bolts 112 engaging front end caps 114 capping the ends of the side rails. The front adjustment bolts 112 and end caps 114 are designed and operate substantially identically to the rear belt adjustment bolts 82 and end caps 84. This is possible because the front slides 104 are formed from the same aluminum extrusion as the bearing slides 80 of the rear, idler roller 28. The front adjustment bolts 112 are thread-forming bolts with flat heads supported in recesses in the front end caps 114. The shafts of the front adjustment bolts 112 extend rearwardly through the front end caps 114 and along the channels 52 of the T-slots of the side rails 22, 24, and finally into the key-hole shaped channels 86 in the front slides 104. The front adjustment bolts 112 are used to adjust the position of the front support frame 36 and the motor 34 carried thereon to obtain the proper tension in the drive belt 90.

The front support frame 36 also supports the stanchion 38 capped by the display and control panel 40 and handle 42 and containing the lift mechanism 44. As shown in FIGS. 9 and 10, the stanchion 38 a roll formed steel tube of substantially square cross-section positioned along the longitudinal cantilever of the treadmill 20 and extending upwardly and rearwardly at an angle of about 15 degrees (15°) from the vertical. The lower end of the stanchion is positioned between the middle and forwardmost front cross members 106b, 106c, and the stanchion support angles 110 extending between

those cross members. The vertical flanges of the stanchion support angles 110 are in proximal contact with and welded to the side surfaces of the stanchion 38. The horizontal flanges of the stanchion support angles 110 extend away from the stanchion 38, and are in proximal contact with and bolted to the upper, horizontal flanges of the middle and forwardmost cross members 106b, 106c of the front support frame 36. The stanchion 38 is thus rigidly supported by the front support frame 36 and cantilevers upwardly and slightly rearwardly therefrom.

The lift mechanism 44 for raising and lowering the forward end of the treadmill 20 is substantially contained within the stanchion tube 38. The lift mechanism 44 comprises an electric lift motor 116 with reduction gear box 118, a screw 120 driven by the lift motor via the gear box, a lift tube 122 within and extending slightly below the stanchion tube 38 and engaging the screw, a transverse base member 124 across the lower end of the lift tube, and two wheels 126 each supporting one end of the base member on the floor or other surface beneath the treadmill 20. The lift mechanism 44 is thus linear in configuration in that the inner lift tube 122 is nested concentrically within and extends linearly downwardly from the open lower end of the stanchion tube 38. This linear design and operation is significantly more precise and reliable than existing prior art lift mechanisms for inclining exercise treadmills, particularly the levered and spring loaded designs discussed above in the section entitled "Description of the Prior Art".

The lift motor 116 is a conventional, alternating current electric motor sized to fit within the stanchion tube 38. The gear box 118 is fixedly attached to the lower end of the lift motor 116, and acts as a reduction gear to reduce the R.P.M. and increase the torque supplied by the lift motor to the

screw 120. The gear box 118 is pivotably supported within the stanchion tube 38 by two opposed lift mounting bolts 128, which permit pivotable movement of the gear box and attached lift motor 116 within the stanchion tube about a transverse horizontal axis through the gear box. This pivotable freedom aids in maintaining alignment between the screw 120 extending below the gear box 118 and the lift tube 122 as it is extended out from below the stanchion tube 38. The lift mounting bolts extend through flange bushings 130 opening through the side walls of the stanchion tube 38, and are threaded tightly into the gear box 118.

The screw 120 is operatively driven by the lift motor 116 via the reduction gear box 118, and engages a threaded sleeve 132 fixedly supported within the upper end of the lift tube 122. The sleeve 132 is internally threaded to engage about nine turns of the threaded screw 120 and is positioned concentrically within the lift tube 122 with the upper end of the sleeve substantially level with the upper end of the lift tube. The lower end of the sleeve 132 is externally threaded, and is securely attached within a collar 134 pivotably supported within the inner tube 122. The collar 134 is a rectangular metal element having a central threaded hole receiving the lower end of the sleeve 132. The collar 134 is pivotably supported within the lift tube 122 by opposed collar mounting bolts 136 extending from the outer surface of the lift tube through flange bushings 138, and into opposed transversely oriented, outwardly opening threaded holes in the collar 134. Mounting the collar 134 pivotably about a transverse horizontal axis parallel to the pivot axis of the lift mounting bolts 128 further aids in maintaining alignment between the screw 120 and the lift tube 122.

As the screw 120 is rotated in a selected first direction by the lift motor 116, the collar 134 is moved away from the motor and gear box 118, thereby extending

the inner lift tube 122 out from the lower open end of the stanchion tube 38. The length of the screw 120 is selected to allow extension of the lift tube sufficient to incline the treadmill 20 at an angle of over 15 degrees (15°). The incline of the treadmill 20 is reduced by retracting the lift tube 122 into the stanchion tube 38, which is accomplished by operating the lift motor 116 in the reverse direction to rotate the screw 120 so as to draw the collar 134 toward the motor and gear box 118.

Parallel concentric alignment of the lift tube 122 within the stanchion tube 38 is maintained by self-lubricating upper thrust bearings 140 affixed to the outer surface of the upper end portion of the lift tube 122, and by additional self-lubricating lower thrust bearings 142, 144 affixed to the inner surface of the lower end portion of the stanchion tube 38. Four upper thrust bearings 140 are affixed to the upper end of the lift tube 122, one on each of the four square sides thereof. Similarly the lower thrust bearings 142, 144 are positioned each on one of the four square sides of the lower end of the stanchion tube 38. A selected two of the lower thrust bearings 144 are adjustable, so that the alignment of the lift tube 122 within the stanchion tube 38 may be adjusted as needed.

A small plastic reel 146 is affixed to the stanchion tube 38 and engages a wire cable 148 affixed to the inner tube 122 and wrapped around the reel. The reel 146 rotates upon extension and retraction of the lift tube relative to the stanchion tube. A multi-turn potentiometer 150 operatively connected to the reel 146 precisely senses such rotation of the reel, thus providing an indication of the incline of the treadmill 20 relative to its initial starting position.

The transverse base member 124 of the lift mechanism 44 is bolted to a metal plate welded across the lower end of the lift tube 122. The base member 124

is a metal box beam of rectangular cross-section extending from the lift tube 122 at the center of the treadmill 20 transversely outwardly toward the side rails 22, 24. The wheels 126 are rotatably mounted at the ends of the base member 124 by bolts extending into plugs having threaded, transversely oriented holes. The wheels 126 allow forward movement of the lower portion of the lift mechanism 44 engaging the floor when the incline of the treadmill 20 is increased. At the rearward end of the treadmill 20, rounded fulcrums 152 are fixedly attached below the lower edges of the side rails 22, 24. The fulcrums are sized so that when the lift tube 122 of the lift mechanism 44 is fully retracted into the stanchion tube 38, the side rails 22, 24 and bed 26 are substantially parallel to the floor or other surface supporting the treadmill 20.

As seen in FIG. 11, the display and control panel 40 atop the stanchion tube 38 provides means for controlling the lift mechanism 44 and the motor 34 driving the tread belt 32. The panel 40 further includes means for displaying information reflecting the operation of the treadmill 20 and the performance of a runner thereon. Movement of the tread belt 32 over the bed 26 and rollers 28, 30 is started by pressing the ENTER START control 154 after entering the weight of the operator. Movement of the tread belt 32 is stopped using one of the STOP controls 156. A STOP control 156 is positioned at each side of the panel 40, and is sized much larger than the other controls so that the runner can readily stop the treadmill 20 in an emergency. The speed of the tread belt 32 over the bed 26 is controlled by adjacent speed decrease and increase controls 158a, 158b. The instantaneous speed of the tread belt 32, the elapsed time since the treadmill 20 was started, and the total distance travelled by the tread belt, are all displayed using a single central digital display 160. Display type indicators 162 adjacent the central display

160 indicate whether the speed, time or distance is being displayed. A selected datum can be displayed on the central display 160 by depressing a hold-scan control 164 as needed.

The incline of the treadmill 20 produced by the lift mechanism 44 is controlled by incline decrease and increase controls 166a, 166b, and is displayed as a percent grade on a digital incline display 168. Depressing the incline increase control 166b causes operation of the lift motor 116 to rotate the screw 120 so as to extend the inner lift tube 122 out from the lower end of the stanchion tube 38, thereby raising the forward end of the treadmill 20 and increasing the incline thereof. Depression of the incline decrease control 166a reverses this process, counterrotating the lift motor 116 and screw 120 and thereby retracting the lift tube 122 into the stanchion 38.

The runner's exertion while using the treadmill is displayed using a digital performance display 170. Performance display type indicators 172 adjacent the performance display 170 allow the single performance display to selectively present the total calories burned by the runner, the calories burned per minute, the runner's METs, and the runner's weight as entered.

As seen in FIGS. 9-11, the handhold 42 is a U-shaped tubular member mounted on the ends of the display and control panel 40 and extending rearwardly therefrom toward the runner. The ends of the U-shaped handhold 42 are mounted in handhold mounting brackets 174. The handhold mounting brackets 174 cap the opposite ends of the casing upon which the display and control panel 40 is mounted and which contains the upper circuit board 48.

The upper circuit board 48 includes an on-board computer suitably programmed to operate the treadmill 20 and interpret commands entered by the runner on the display and control panel 40. The lower circuit board

46 is mounted atop the front support frame 36 adjacent the lower end of the stanchion tube 38, and is primarily dedicated to controlling the motor 34 driving the tread belt 32 and the lift motor 116 driving the lift mechanism 44. A conventional DB-9 data connector 176 located on the underside of the casing of the display and control panel 40 allows the on-board computer of the lower circuit board 46 to be monitored, controlled, and reprogrammed as necessary. By connecting an external computer such as a personal computer to this connector 176, the runner's performance can be closely monitored and the operation of the treadmill 20 can be tailored to the runner's ability.

It will be appreciated that, although specific embodiments of the invention have been described herein for purposes of illustration, various modifications may be made without departing from the spirit and scope of the invention. Accordingly, the scope of the invention is not limited except as by the following claims.

Claims

WHAT IS CLAIMED IS:

1. A treadmill comprising:

first and second parallel side members, each having a T-slot opening toward the opposite side member and extending substantially the full length of the side member, the T-slot including an interior channel in the side member having a vertical dimension greater than the vertical dimension of the opening of the T-slot;

a horizontal bed between the side members;

means fixably yet slidably engaging the T-slots of the side members for supporting the bed on the side members;

an endless belt longitudinally encircling the bed;

first and second rollers positioned transversely between the side members within the circumference of the belt at opposite ends of the bed;

means fixably yet slidably engaging the T-slots of the side members for rotatably supporting the first and second rollers; and

means for moving the belt over the bed and rollers.

2. A treadmill as recited in claim 1, wherein the side members comprise substantially flat, vertically oriented members, and the vertical dimensions of the channels of the T-slots therein are greater than the transverse horizontal dimensions thereof.

3. A treadmill as recited in claim 2, wherein the vertical dimension of each channel is at least three times the horizontal dimension thereof.

4. A treadmill as recited in claim 1, wherein the side members include integrally formed, inwardly extending horizontal landings.

(a) A treadmill as recited in claim 4, wherein the landings extend inwardly over the side edges of the belt.

(b) A treadmill as recited in claim 4, wherein the inward edges of the landings are supported on the bed.

5. A treadmill as recited in claim 6, wherein the landings include downwardly extending resilient spacers fixably attached thereunder.

6. A treadmill as recited in claim 1, wherein the roller supporting means includes slide members having flanges sliding within the channels of the side members, and external bearings affixed to the slide members for journably receiving transversely extending portions of the roller.

7. A treadmill as recited in claim 1, further including transverse means for supporting the center of the bed.

(a) A treadmill as recited in claim 1, further including means engaging the T-slots of the side members for fixably yet slidably supporting the belt moving means on the side members.

8. A treadmill as recited in claim 10, wherein the means for supporting the belt moving means includes slide members having flanges sliding within the channels of the side members.

(a) A treadmill as recited in claim 9 further comprising:

an upstanding outer tube fixedly supported on the side members;

an inner tube slidable within the outer tube and supported on the surface below the treadmill; and

means for extending and retracting the inner tube relative to the outer tube.

9. A treadmill as recited in claim 12, wherein the means for extending and retracting the inner tube comprises:

an elongated screw positioned within and parallel to the outer and inner tubes;

means fixedly attached to one of the tubes for rotating the screw in either direction; and

means fixedly attached to the other one of the tubes for receiving the screw and engaging the threads thereof.

10. In a treadmill having side members, a horizontal bed supported between the side members, transverse rollers supported between the side members at opposite ends of the bed, a belt encircling the bed and rollers, and means for moving the belt over the bed and rollers, the improvement characterized by a lift mechanism comprising:

an upstanding outer tube fixedly attached at a selected end of the treadmill;

an inner tube slidable within the outer tube, the lower end of the inner tube being supported on the surface below the treadmill; and

means for extending and retracting the inner tube relative to the outer tube, thereby raising and lowering the selected end of the treadmill.

11. The improvement as recited in claim 14, wherein the means for extending and retracting the inner tube comprises:

a lift motor fixedly attached within the upper end of the outer tube;

a screw operatively connected to the motor and extending downwardly into the inner tube, the motor being capable of selectively rotating the screw in either direction about the screw's longitudinal axis; and

a reaction member fixedly attached to the inner tube and having a threaded aperture for receiving and engaging the threaded screw.

12. The improvement as recited in claim 15, further comprising:

a cross member fixedly attached perpendicularly to the lower end of the inner tube; and

a wheel rotatably mounted at each end of the cross member.

13. The improvement as recited in claim 15, further comprising means for measuring the longitudinal extension of the inner tube relative to the outer tube.

14. The improvement as recited in claim 17, wherein the extension measuring means comprises:

a flexible member carried on the inner tube, parallel to the longitudinal axis thereof;

a reel positioned below and fixed relative to the outer tube, the reel engaging the flexible member such that extension or retraction of the inner tube relative to the outer tube produces rotation of the reel; and

means for measuring rotation of the reel.

(a) In a treadmill having side members, a horizontal bed supported between the side members, transverse rollers supported between the side members at opposite ends of the bed, a belt encircling the bed and rollers, and means for moving the belt over the bed and rollers, the improvement characterized by:

means affixed to the side members for covering the side edges of the belt.

15. The improvement as recited in claim 19, wherein the means for covering the edges of the belt comprises inwardly extending horizontal landings.

16. The improvement as recited in claim 20, wherein the landings are formed integrally with the side members.

17. The improvement as recited in claim 20, wherein the inward edges of the landings are supported on the bed by downwardly extending spacers fixably attached thereunder.

AMENDED CLAIMS
[received by the International Bureau
on 3 August 1988 (03.08.88);
original claims 1-17 replaced by amended claims 1-29 (6 pages)]

1. In a treadmill having side members, a horizontal bed supported between the side members, transverse rollers supported between the side members at opposite ends of the bed, a tread belt encircling the bed and rollers, and means for moving the belt over the bed and rollers, the improvement characterized by:

means affixed to the side members which overlie the side edges of the belt throughout the upwardly exposed length thereof.

2. The improvement according to claim 1, wherein the means overlying the edges of the belt comprise landings extending inwardly over the side edges of the belt.

3. A treadmill according to claim 2, wherein the landings are formed integrally with the side members.

4. A treadmill according to claim 3, wherein the landings are integral with the side rails and the inner edges thereof are closely adjacent to the edges of the tread belt.

5. A treadmill according to claim 4, wherein the inward edges of the landings are supported on the bed by downwardly extending spacers fixably attached thereunder.

6. A treadmill according to claim 4, wherein said landings include means arranged along the bottom surface thereof providing an inwardly open recess between the lower surface of the landing and the treadmill bed so that the lower surface of the landing at its inner edge is spaced just above the edge of the belt and such

recess may accommodate any excess transverse movement of the belt.

7. A treadmill according to claim 1, wherein the edges of the tread belt throughout the length thereof are covered by treadmill structure, including landings spaced above the belt edges throughout the upwardly exposed portion of the belt, such edges also being covered in the course thereof around the rear roller by end caps on the siderails.

8. A treadmill according to claim 1, wherein the level of the upwardly exposed portion of the belt is at a level below the level of the lower surfaces of the landings and the space between the inner edges of the landings does not exceed the width of the belt.

9. A treadmill according to claim 1, wherein the inner edge of each landing is spaced above the associated edge of the belt and the inner edges of the landings are spaced apart a distance not greater than the width of the belt.

10. A treadmill according to claim 9, wherein said landings are configured to provide inwardly open recesses thereunder so that the belt edges may track under said landings.

11. In a treadmill having side members, a horizontal bed supported between the side members, transverse rollers supported between the side members at opposite ends of the bed, a tread belt encircling the bed and rollers, and means for moving the belt over the bed and rollers, the improvement characterized by:

a single upstanding stanchion located centrally at one end of the treadmill, with a display and control panel and with handhold means arranged at the top of the stanchion.

12. A treadmill according to claim 11, comprising lift mechanism housed within the stanchion, by means of which the one end of the treadmill may be elevated relative to the other end thereof.

13. A treadmill according to claim 12, wherein said lift mechanism comprises two tubular elements of generally rectangular cross-section, one within and extendible with respect to the other, with the lower such tubular member having attached thereto a cross member with support wheels thereon which extend below the bed of the treadmill.

14. A treadmill according to claim 13, further comprising means for measuring the longitudinal extension of the inner tube relative to the outer tube.

15. A treadmill according to claim 14, wherein the extension measuring means comprises:

a flexible member carried on the inner tube, parallel to the longitudinal axis thereof;

a reel positioned below and fixed relative to the outer tube, the reel engaging the flexible member such that extension or retraction of the inner tube relative to the outer tube produces rotation of the reel; and

means for measuring rotation of the reel.

16. In a treadmill having side members, a horizontal bed supported between the side members, transverse rollers supported between the side members at opposite ends of the bed, a belt encircling the bed and rollers, and means for moving the belt and rollers, and means for moving the belt over the bed and rollers, the improvement characterized by a lift mechanism comprising:

an upstanding outer tube fixedly attached at a selected end of the treadmill;

an inner tube slidable within the outer tube, the lower end of the inner tube being supported on the surface below the treadmill; and

means for extending and retracting the inner tube relative to the outer tube, thereby raising and lowering the selected end of the treadmill.

17. A treadmill according to claim 16, wherein the tubes are of generally rectangular cross-section and the means for extending and retracting the inner tube comprises:

a lift motor fixedly attached within the upper end of the outer tube;

a screw operatively connected to the motor and extending downwardly into the inner tube, the motor being capable of selectively rotating the screw in either direction about the screw's longitudinal axis; and

a reaction member fixedly attached to the inner tube and having a threaded aperture for receiving and engaging the threaded screw.

18. A treadmill comprising:

first and second parallel side members, each having a T-slot opening toward the opposite side member and extending substantially the full length of the side member, the T-slot including an interior channel in the side member having a vertical dimension greater than the vertical dimension of the opening of the T-slot;

a horizontal bed between the side members;

a means fixably yet slidably engaging the T-slots of the side members for supporting the bed on the side members;

an endless belt longitudinally encircling the bed;

first and second rollers positioned transversely between the side members within the circumference of the belt at opposite ends of the bed;

means fixably yet slidably engaging the T-slots of the side members for rotatably supporting the first and second rollers; and

means for moving the belt over the bed and rollers.

19. A treadmill as recited in claim 18, wherein the side members comprise substantially flat, vertically oriented members, and the vertical dimensions of the channels of the T-slots therein are greater than the transverse horizontal dimensions thereof.

20. A treadmill as recited in claim 18, wherein the vertical dimension of each channel is at least three times the horizontal dimension thereof.

21. A treadmill is recited in claim 18, wherein the side members include integrally formed, inwardly extending landings.

22. A treadmill as recited in claim 21, wherein the landings extend inwardly over the side edges of the belt along the full length of the upwardly exposed portion of the belt.

23. A treadmill as recited in claim 21, wherein the inward edges of the landings are supported on the bed in a manner leaving an inwardly open space between the bed and the bottom of the landing.

24. A treadmill as recited in claim 18, wherein the roller supporting means includes slide members having flanges slidable within the channels of the side members, and external bearings affixed to the slide members for journably receiving transversely extending portions of the roller.

25. A treadmill as recited in claim 18, further including transverse means for supporting the center of the bed.

26. A treadmill as recited in claim 18, further including means engaging the T-slots of the side members for fixably yet slidably supporting the belt moving means on the side members.

27. A treadmill as recited in claim 26, wherein the means for supporting the belt moving means includes slide members having flanges sliding within the channels of the side members.

28. A treadmill as recited in claim 18, further comprising a lift mechanism including

an upstanding outer tube fixedly attached at a selected end of the treadmill,

an inner tube slidable within the outer tube and supported on the surface below the treadmill; and

means for extending and retracting the inner tube relative to the outer tube, thereby raising and lowering the selected end of the treadmill.

29. A treadmill as recited in claim 28, wherein the means for extending and retracting the inner tube comprises;

an elongated screw positioned within and parallel to the outer and inner tubes;

means fixedly attached to one of the tubes for rotating the screw in either direction; and

means fixedly attached to the other one of the tubes for receiving the screw and engaging the threads thereof.

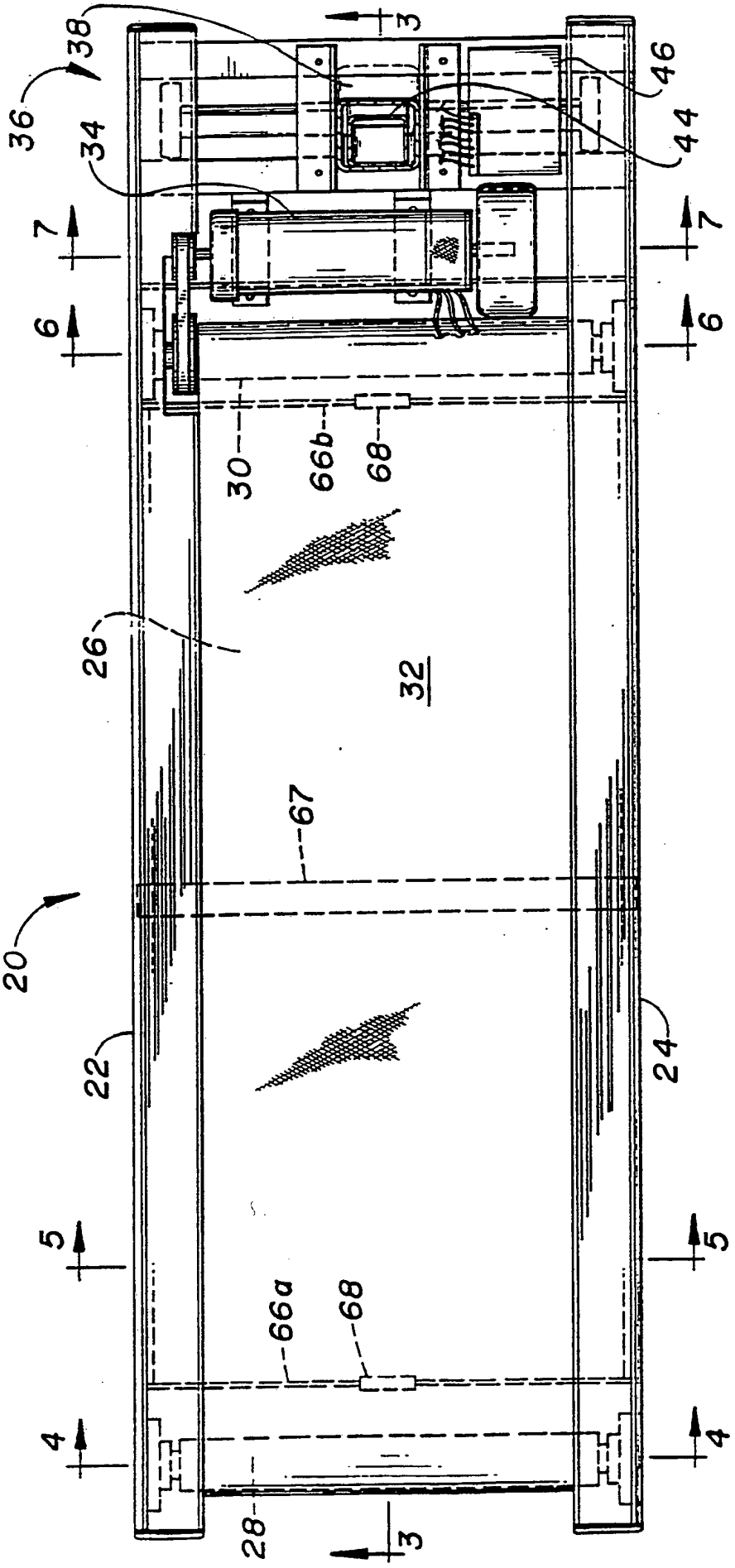


FIG. 1

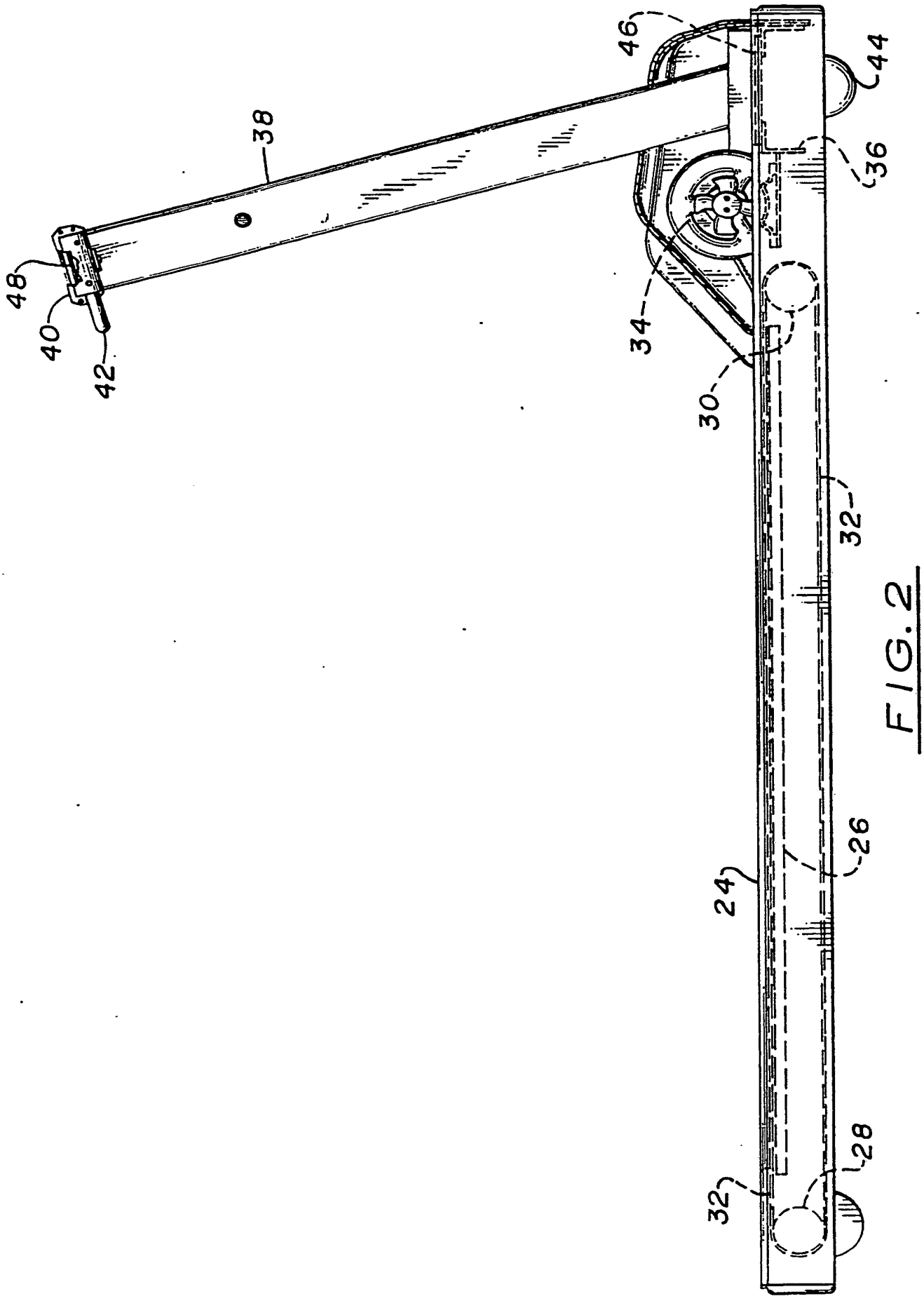
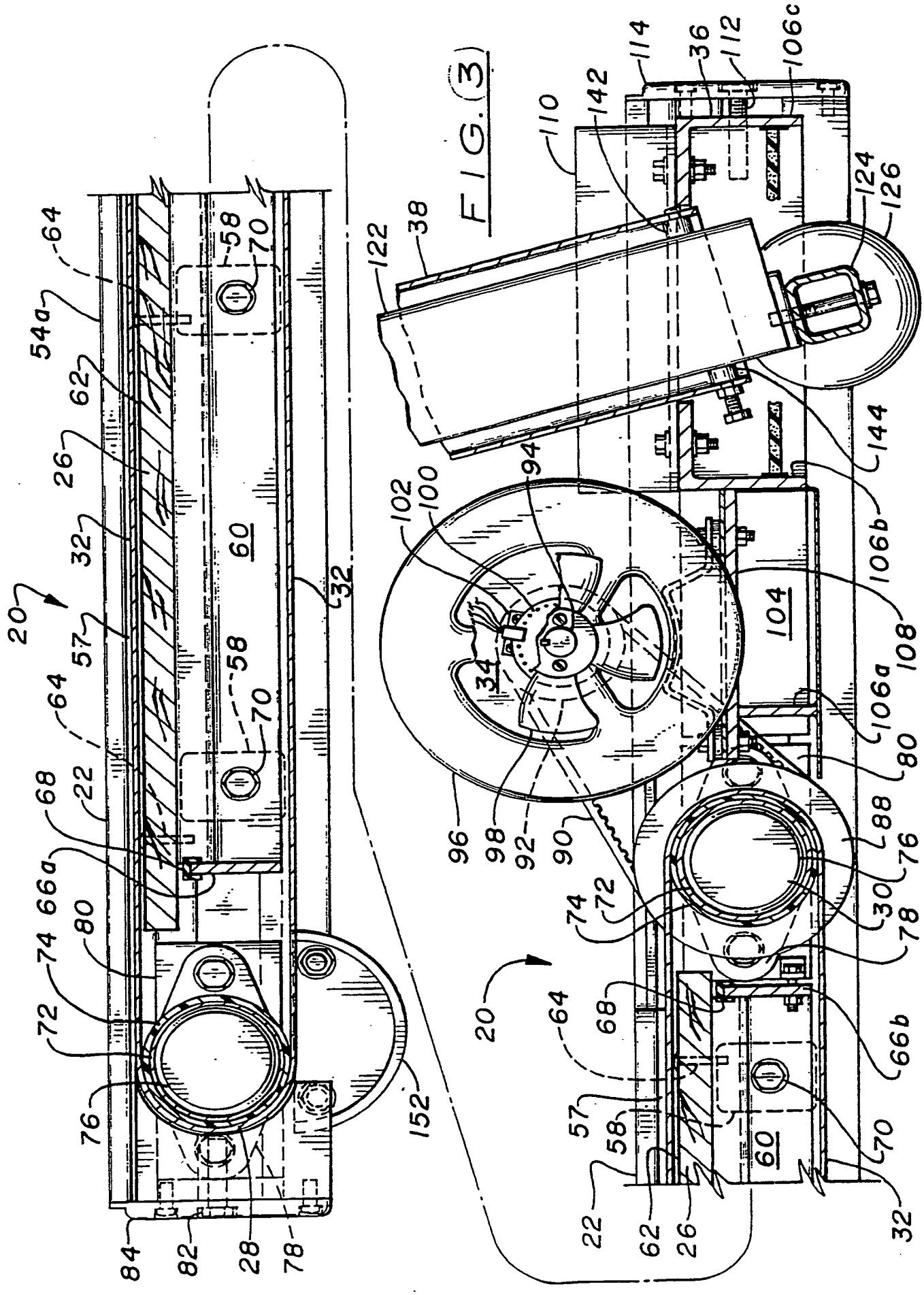


FIG. 2

FIG. (3)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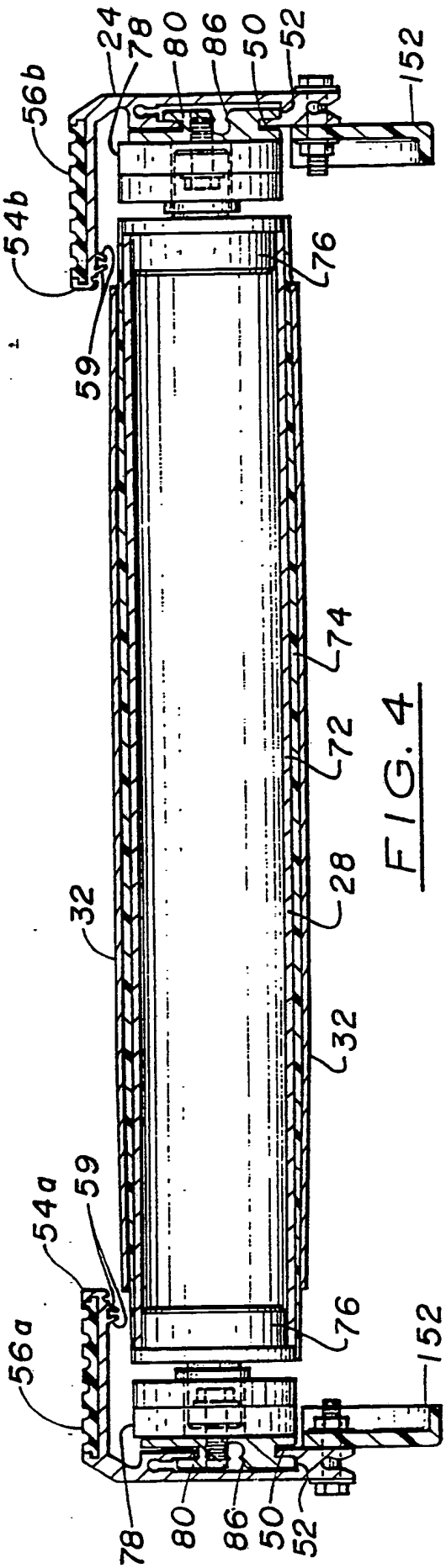
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52

FIG. 4

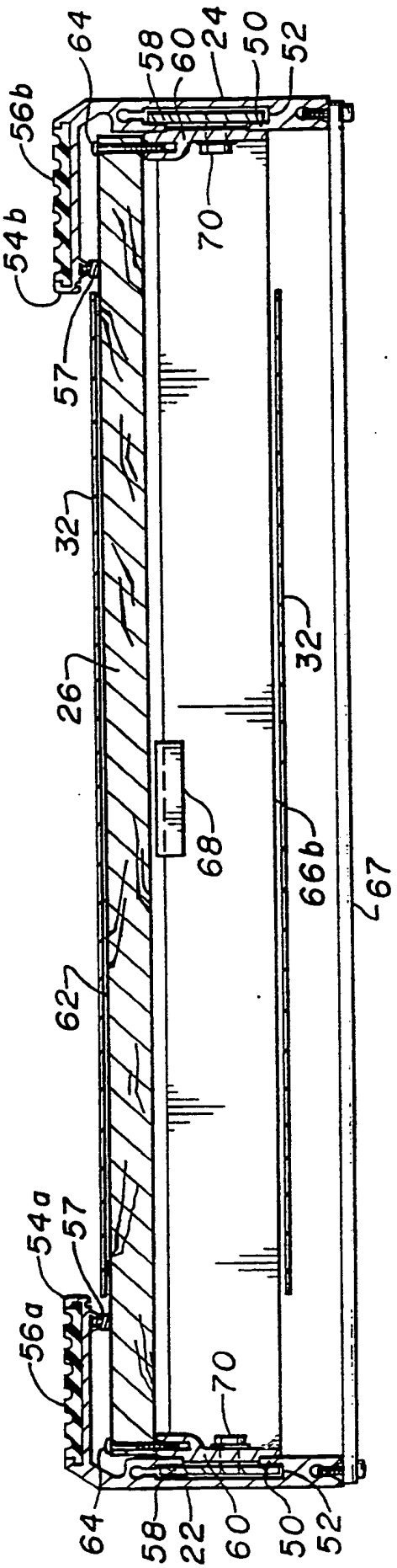
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FIG. 5

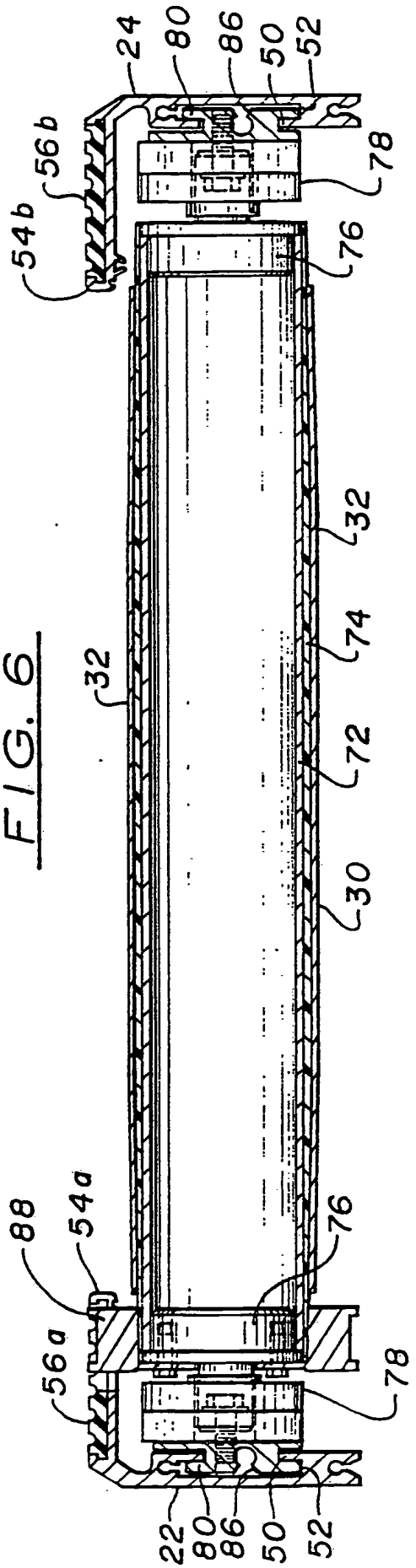
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FIG. 6

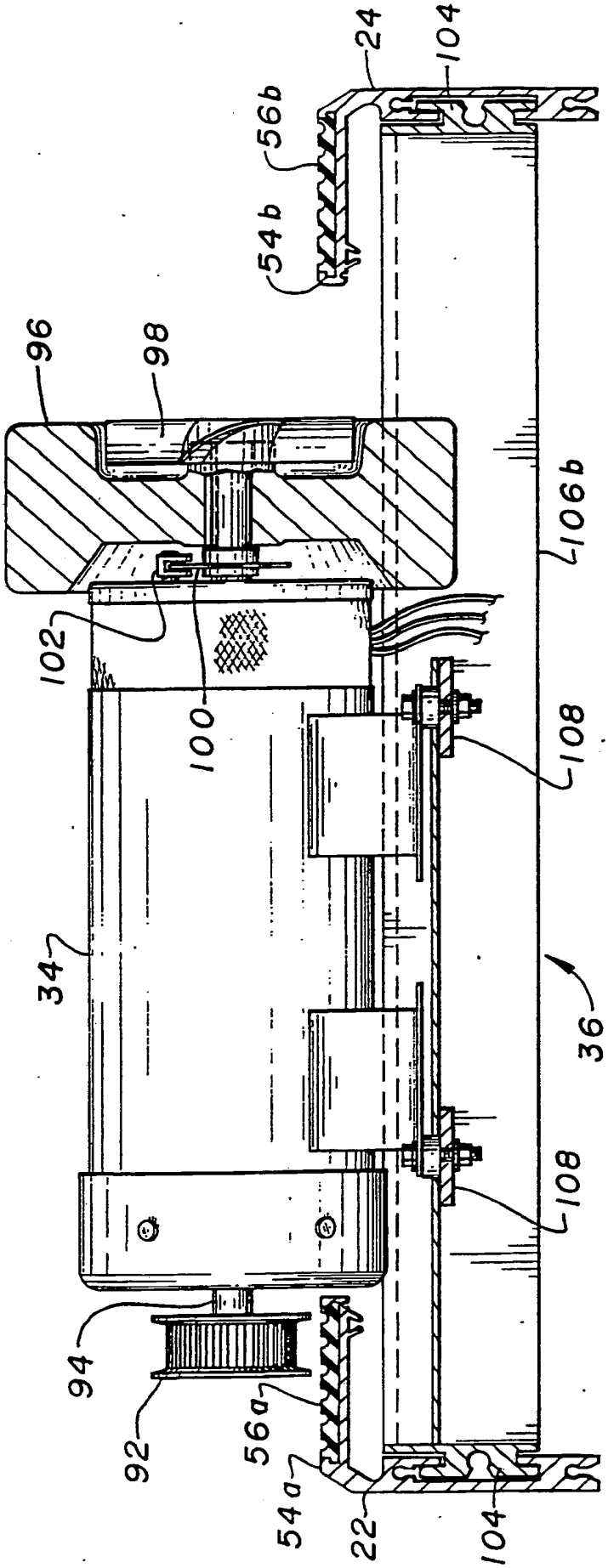
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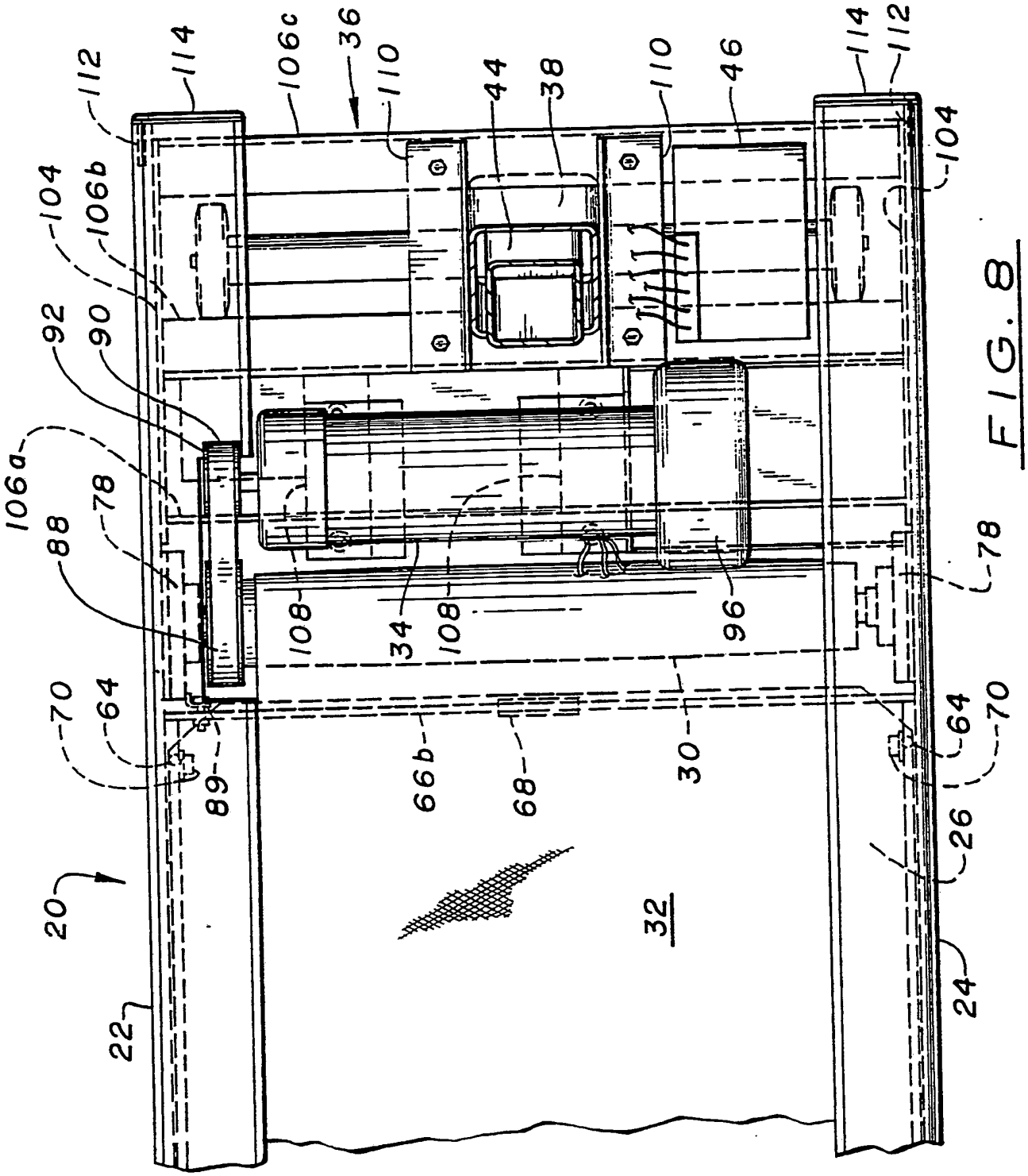
FIG. 7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22
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FIG. 8

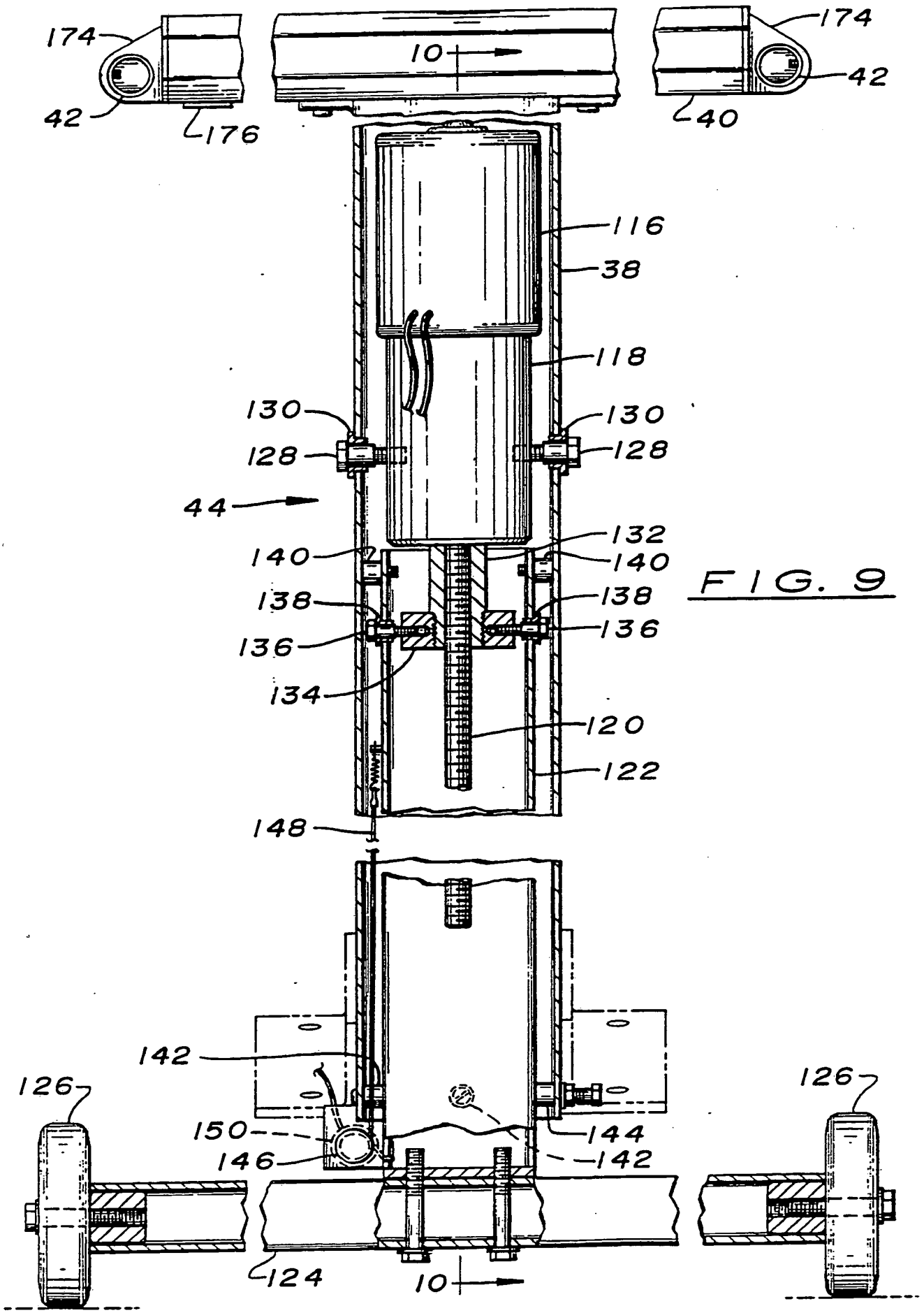
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FIG. 9

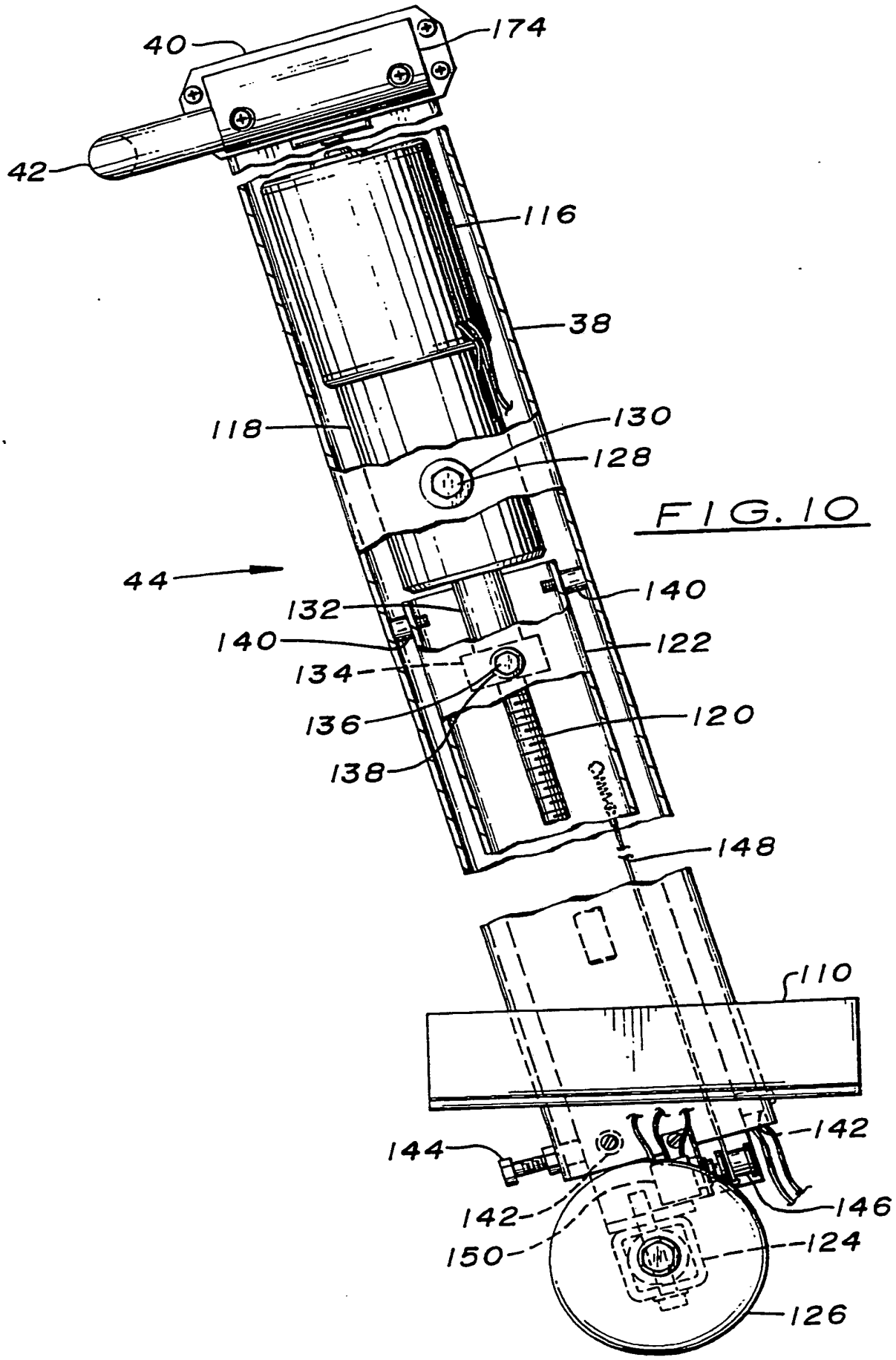
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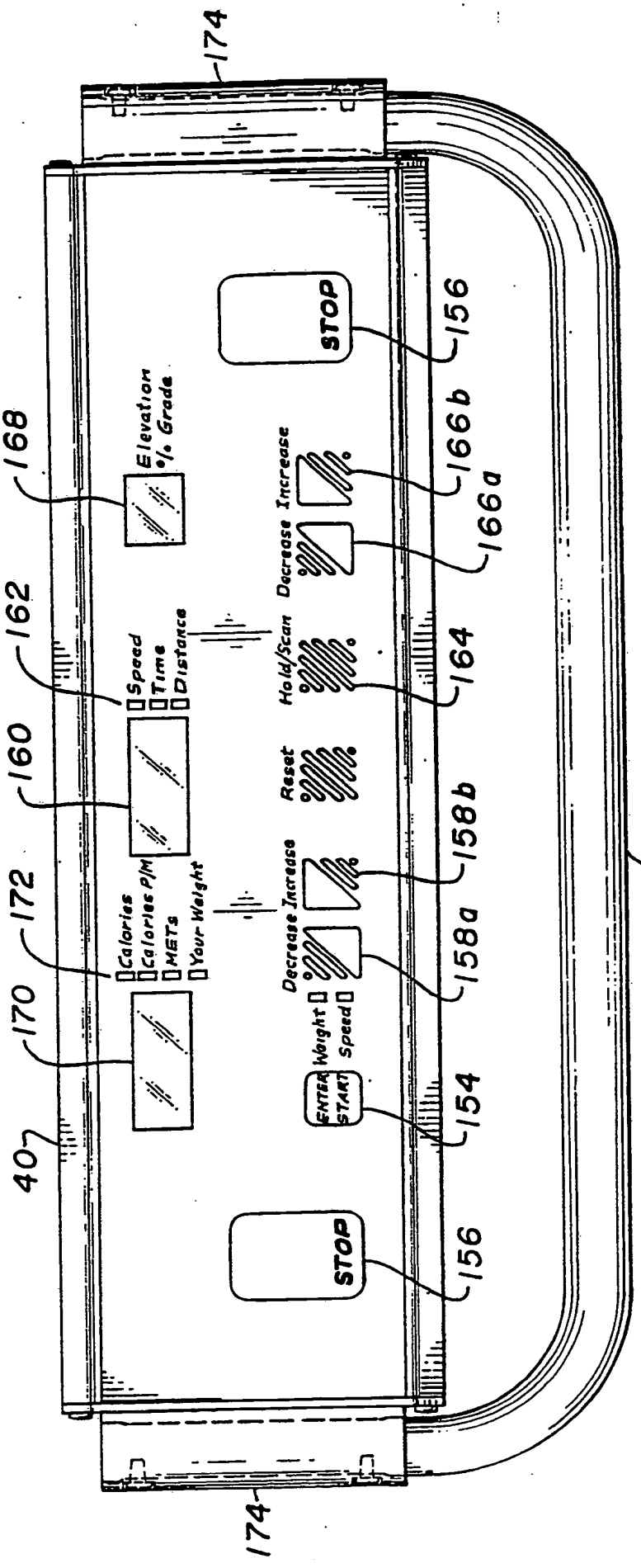
FIG. 10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166a
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162
Speed
Time
Distance
Hold/Scan
164
160
Reset
158b
Calories
Calories P/M
METs
Your Weight
Decrease Increase
172
158a
170
Weight
Speed
ENTER
START
154
40
STOP
156
42
174

FIG. 11

INTERNATIONAL SEARCH REPORT

International Application No PCT/US88/00444

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC (4): A63B 23/06
U.S. Cl. 272/69

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	272/69, 70, 72, 97 , Dig. 4 198/842, 860.1, 861.1, 861.5

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
Y	US, A, 4,616,822 (TRULASKE ET AL) 14 October 1986, see column 4, lines 16-26 and lines 47-50.	1, 2, 3, 4, 7, 16, 17
A	US, A, 4,618,140 (BROWN) 21 October 1986 See Figure 1 (T-channel 16, flange 14).	1, 2, 3
A	US, A, 4,602,779 (OGDEN ET AL) 29 July 1986, see Figure 7 and column 21, lines 18-44.	9-17
A	US, A, 3,703,284 (HESEN) 21 November 1972 See Figure 2, scale 24.	13
A	US, A, 3,643,943 (ERWIN, JR. ET AL) 22 February 1972, see column 2, lines 23-27 and column 3, lines 28-34.	9-17

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
04 May 1988	0 8 JUN 1988
International Searching Authority [1]	**Signature of Authorized Officer [20]**
ISA/US	S.R. Crow S R. Crow